

APPENDIX D

BLUE SKY PROJECT WATER MANAGEMENT PLAN

CBM Produced Water (Injection)

Pedco plans to inject produced water (coalbed formation water) from the Blue Sky Project exploratory CBM wells into two injection wells, ARFederal 1591-8I, located in the SENW of Section 8, R15N T91W, and ARFederal 1591-9I, located in the SWSW of Section 9, R15N T91W. No surface discharge would occur. As Pedco would inject all produced water, no surface waters would be affected by Pedco's management of CBM produced water. Likewise, existing reservoirs or stock ponds would not be affected.

Before the injection wells are drilled and completed, water produced from CBM wells may be transported to nearby drilling locations and used to drill additional wells. Any produced water would be contained in the drilling reserve pit constructed on each well pad until the injection wells are completed. Once all wells have been drilled, water produced at the exploratory well sites would be gathered and transported to the injection wells for disposal, which would be permitted by all necessary agencies.

Produced water would be collected in a buried two-inch polyethylene flowline (pipeline) for transport to the water disposal facility location (200' x 200') approved by the WOGCC and the BLM. Best Management Practices (BMPs) would be used for erosion control and the diversion of overland flows away from the facility. A typical water disposal facility consists of four 400 bbl water tanks, a pump house, piping, and a well house. Transfer pumping stations, consisting of a 400 bbl water tank with associated pump and piping, may be needed. Locations of water transfer facilities will be submitted via Sundry Notice.

The produced water from 14 CBM wells would be injected into the ARFederal 1591-9I well, an approximate minimum of 7,200 bbls/day and maximum of 19,200 bbls/day. The remaining 10 wells would be injected at the ARFederal 1591-8I well, an approximate minimum of 5,142 bbls/day and maximum of 23,500 bbls/day.

See attached diagrams of **Injection well, Water Transfer Facility and Water Disposal Facility** in **Appendix B**.

Aquifer Protection

The proposed injection targets for each injection well are the Cherokee Sandstone (approximately 3,900 to 4,400 feet below the surface) and the Deep Creek Sandstone (approximately 4,200 to 4,700 feet below the surface), stratigraphically below the coal zones being explored. These sandstones are isolated above and below by competent shale barriers that would prevent the initiation and propagation of fractures through overlying strata to any fresh water zones. The Cherokee and Deep Creek Sandstones consist of clean, medium to coarse-grained sandstone.

The injection wells would be drilled, cased, and cemented from TD (50 feet below the base of the Cherokee and/or Deep Creek Sandstone) to the surface. The Cherokee and/or Deep Creek Sandstone would be tested to determine its suitability for water disposal prior to any injection activities. Open hole logs and injectivity tests would be provided to all necessary agencies. Also, prior to injection of produced water from coalbed methane wells, a water analysis from the Cherokee and/or Deep Creek Sandstone would be obtained and provided to all necessary agencies. Produced water would come from coals in the Mesaverde Group.

Existing Natural Conditions

Watershed Characteristics and Surface Water Quality

The Blue Sky Project is located in Hydrologic Unit (HUC) 14050004, Muddy, located in the Upper Colorado Region. Cow Creek and Dry Cow Creek converge in the project area, and Cow Creek eventually flows into Muddy Creek. USGS Station 09259000, known as Muddy Creek near Baggs, WY, is located on Muddy Creek at the confluence of Muddy Creek and the Little Snake River and measures flow and water quality from the HUC. Data from this station are found in **Tables 1 and 2**.

Groundwater Quality

One permitted water well exists within one mile of the project area, but is not located within the circle of influence (one-half mile radius) of any proposed CBM well. The WRDS Water Quality Database groundwater data from the Mesaverde Group near the project area are reported in **Table3**.

Table 1 Surface Water Quality Data, Station 09259000													
Parameter	Specific Conductance	pH	Nitrite (mg/L)	Hardness (mg/L as CaCO3)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	SAR	K (mg/L)	Cl (mg/L)	SO4 (mg/L)	Solids Evap (mg/L)	TSS (mg/L)
Mean	967	8	0.4	270	42	40	286	6.8	8.5	32.3	320	346	3191
Count	3	3	1	2	2	2	1	1	1	2	2	1	41

* All cation and anion concentrations are dissolved.

Table 2 Peak Flow Estimates from HUC 14050005			
Mean Annual Flow Estimate (cfs)			322.88
Peak flow (PT) estimates:	Exceedence Probability	Peak Flow (cfs per square mile)	Peak Flow for Entire Watershed (cfs)
Recurrence Interval			
2 year	0.5	2.32	2,361.90
5 year	0.2	3.93	3,989.65
10 year	0.1	5.07	5,153.97
25 year	0.04	6.98	7,091.53
50 year	0.02	8.76	8,904.84
100 year	0.01	10.29	10,459.77

* Calculations taken from Lowham, Streamflows in Wyoming

Table 3 Groundwater Quality Data, Station 411608107373701																	
Parameter	Specific Conductance	pH	Bicarbonate (mg/L)	Carbonate (mg/L)	Nitrogen Amm + Org (Tot, mg/L)	NO2 +NO3 (Diss, mg/L)	P (Tot, mg/L)	Hardness (Tot, mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	SAR	K (mg/L)	Cl (mg/L)	SO4 (mg/L)	Fe (mg/L)	TSS (mg/L)
Value	2000.00	8.40	1300.00	14.00	0.82	0.01	0.07	11.00	2.80	0.90	510.00	68.00	4.30	39.00	11.00	40.00	1230.00
* Unless, listed otherwise, all cation and anion concentrations are dissolved																	

Certification

Pedco hereby certifies that:

1. All potentially affected landowners having properly permitted water wells with the WSE within each proposed wells Circle of Influence (one-half mile radius) were offered a Water Well agreement; and
2. If a Water Well Agreement is not reached with the landowner, Pedco agrees to mitigate the impacts of its coalbed methane wells in accordance with State of Wyoming water laws; and
3. Pedco has applied for a Permit to Appropriate Groundwater from the Wyoming State Engineers Office, concurrently with the Applications for Permit to Drill.

Lessees Representation and Certification – Blue Sky Project

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